GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

FIRENZE
FLORENCE
2017

Cateteri venosi per emodialisi nel 2017: lo stato dell'arte

Maurizio Gallieni

Nephrology and Dialysis Unit

Ospedale S. Carlo Borromeo, ASST Santi Paolo e Carlo,

University of Milano, Milano, Italy

Ospedale San Carlo Borromeo
Sistema Socio Sanitario
Regione Lombardia
ASST Santi Paolo e Carlo

Università degli Studi di Milano
Facoltà di Medicina e Chirurgia

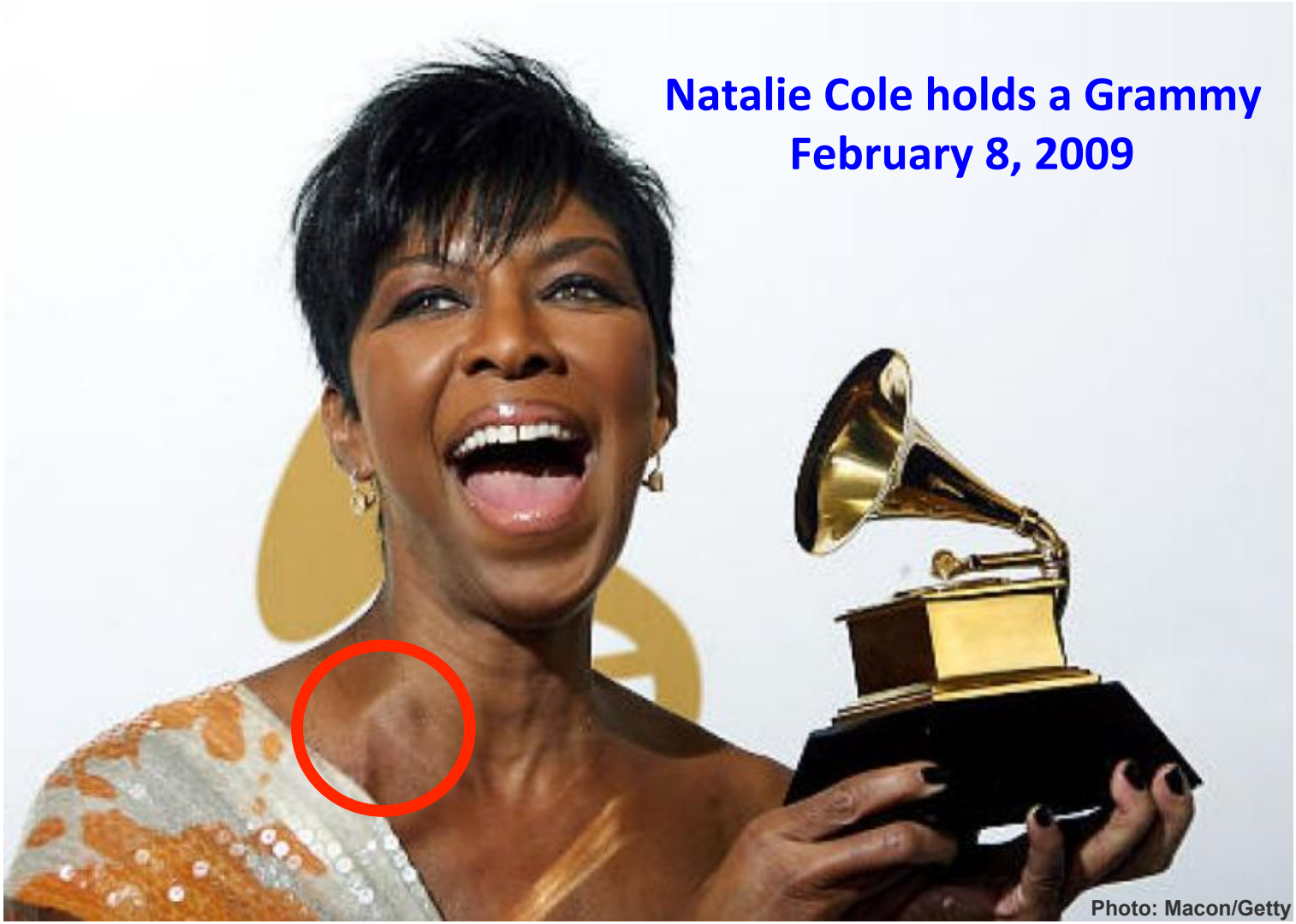
Kidney International 1999; 56: 1-17

The hemodialysis catheter conundrum: Hate living with them, but can't live without them

STEVE J. SCHWAB and GERALD BEATHARD

Duke University Medical Center, Durham, North Carolina, and Austin Diagnostic Clinic, Austin, Texas, USA

"Our ability to care for the dialysis patient has been considerably enhanced by the development and availability of catheters, both temporary and chronic"


Natalie Cole holds a Grammy
February 8, 2009
Photo: Macon/Getty

Ideal Dialysis Catheter

- Easy to insert and remove
- Inexpensive
- Free of infection
- Free of fibrin sheath (“invisible to body”)
- Does not cause venous thrombosis or stenosis
- Delivers high flow (>400 ml/min) reliably
- Durable

Scott Trerotola - Radiology 2000; 215:651-658

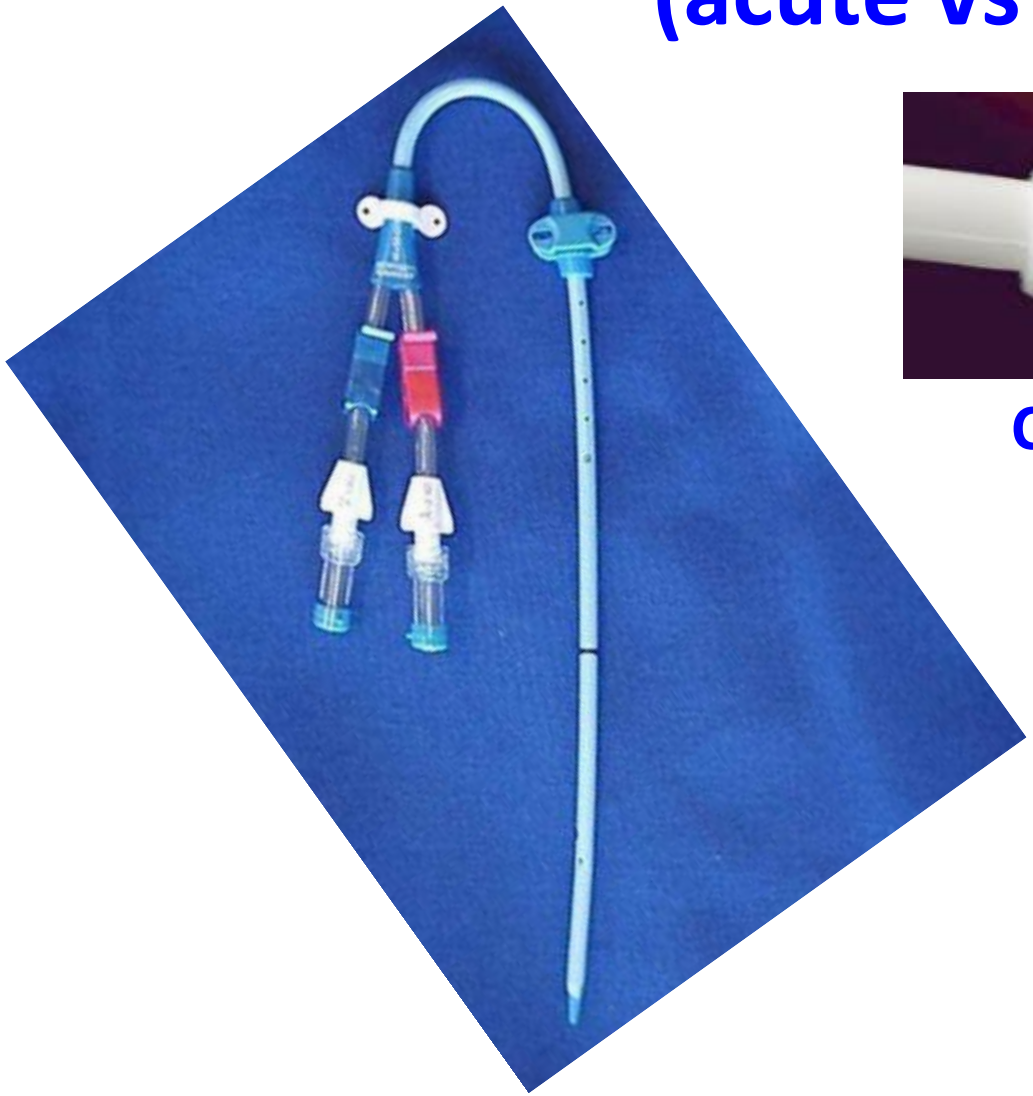
CVC for hemodialysis
State of the art

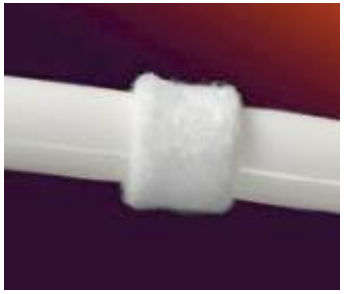
- Catheter design: Temporary vs long term tunneled CVC
- Antegrade versus retrograde tunneling
- Tip design and tip positioning
- New devices: inside-out access

CVC for hemodialysis
State of the art

- **Catheter design: Temporary vs long term tunneled CVC**
- **Antegrade versus retrograde tunneling**
- **Tip design and tip positioning**
- **New devices: inside-out access**

Non-tunnelled vs tunnelled catheters (acute vs chronic)



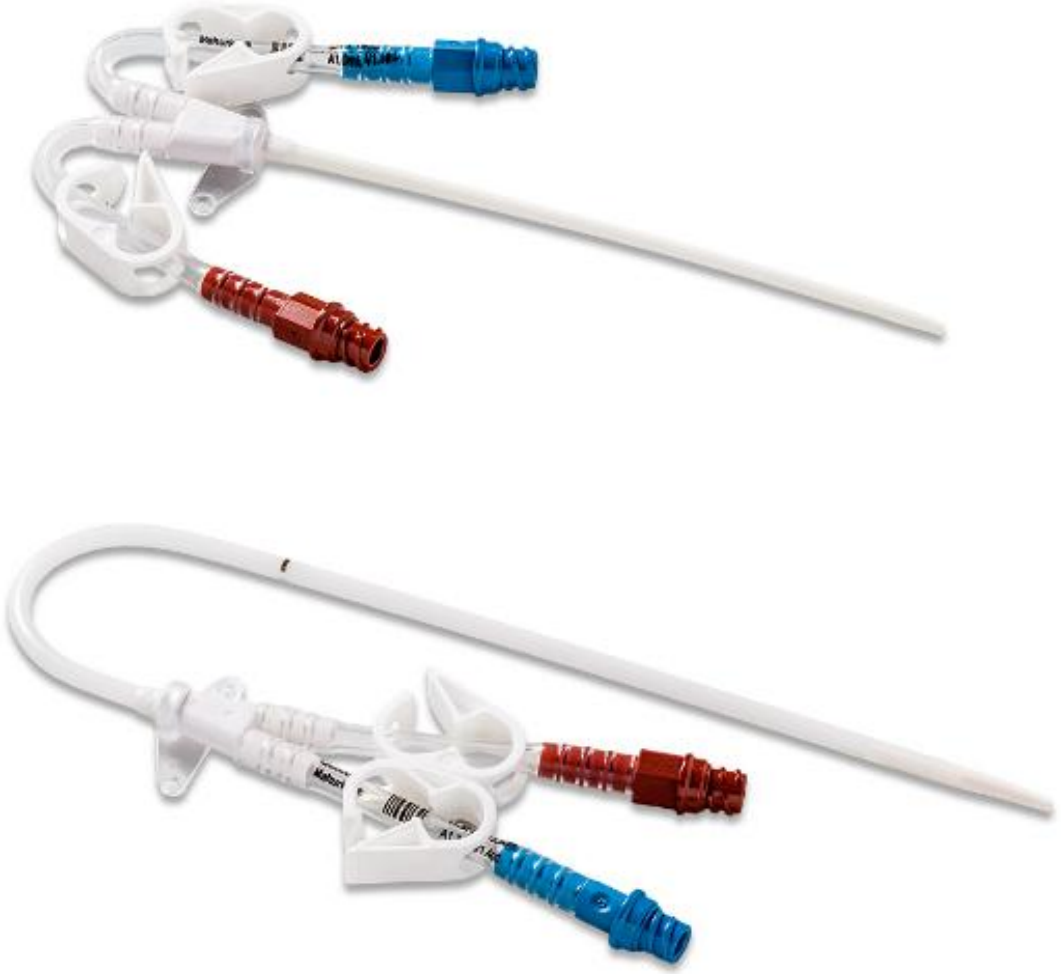


Cuff

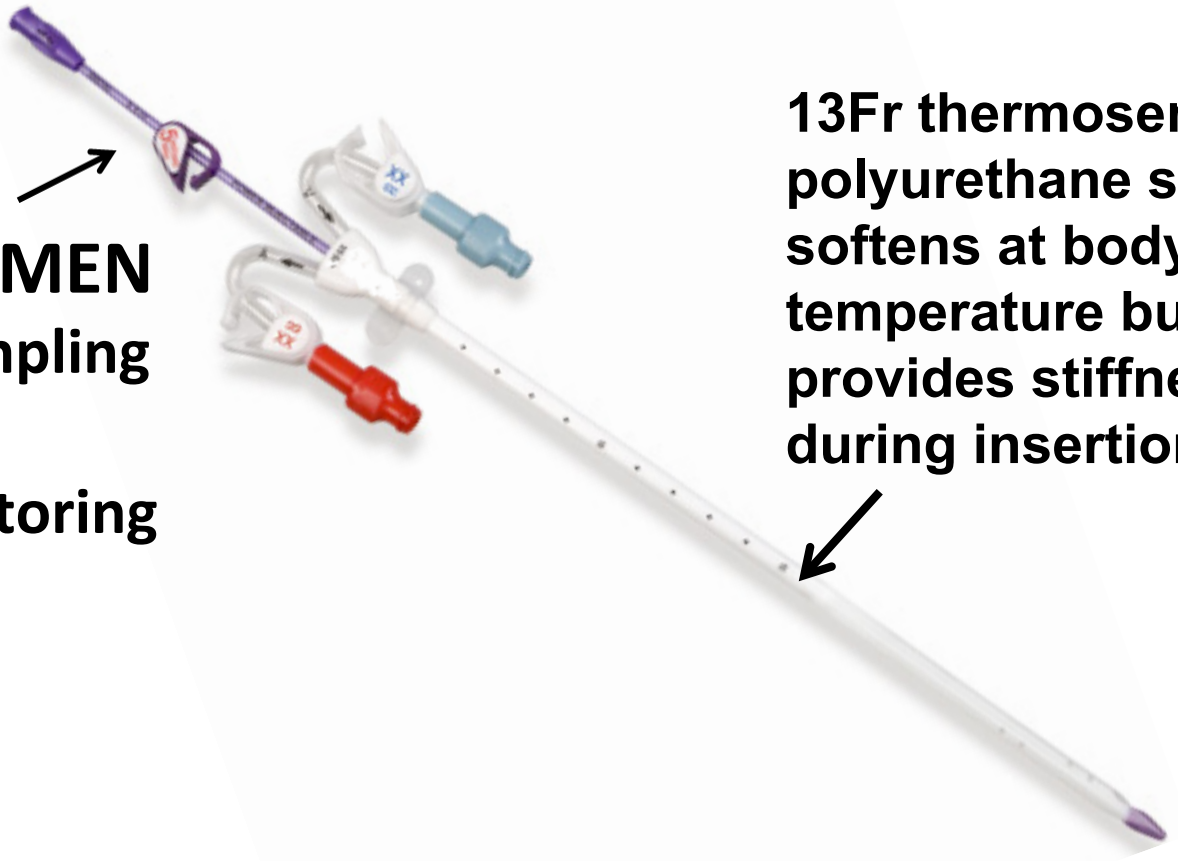
Pre-curved

Split tip

Temporary, uncuffed, precurved dialysis CVC



Acute dialysis catheter design



3rd LUMEN

Blood sampling

Infusions

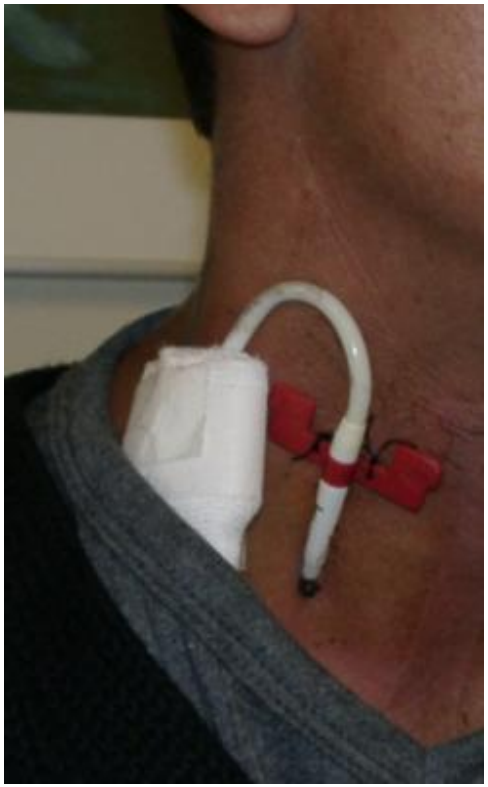
CVP monitoring

13Fr thermosensitive polyurethane shaft that softens at body temperature but still provides stiffness during insertion

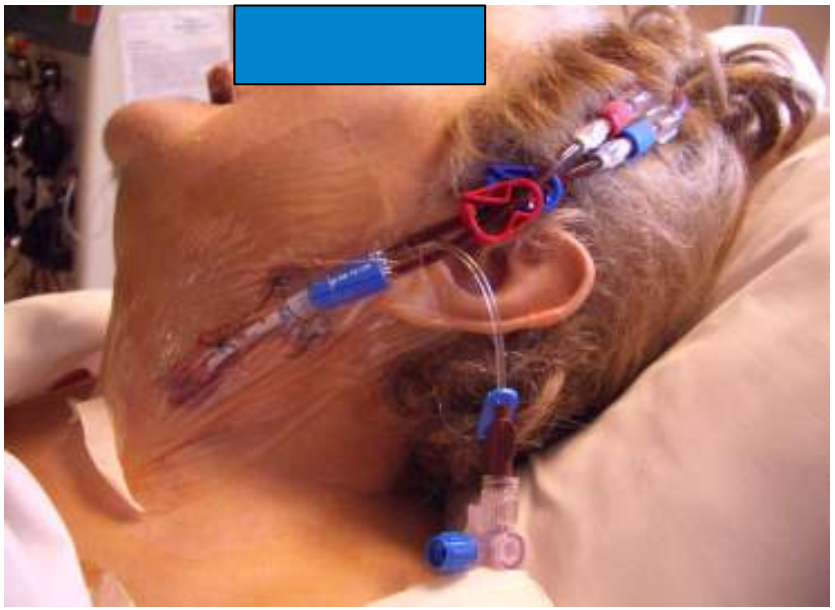
Soft tip

Acute dialysis catheter design

Acute dialysis catheter design

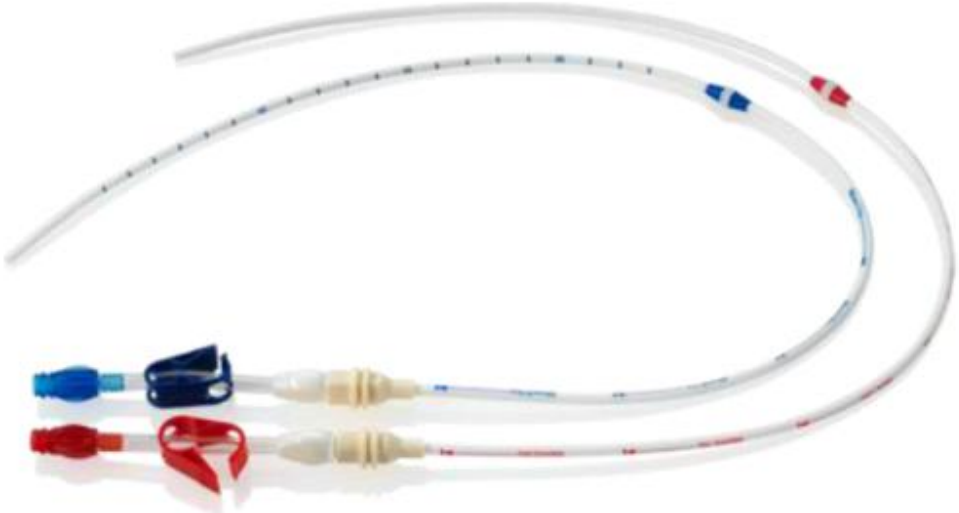


Remember patient comfort



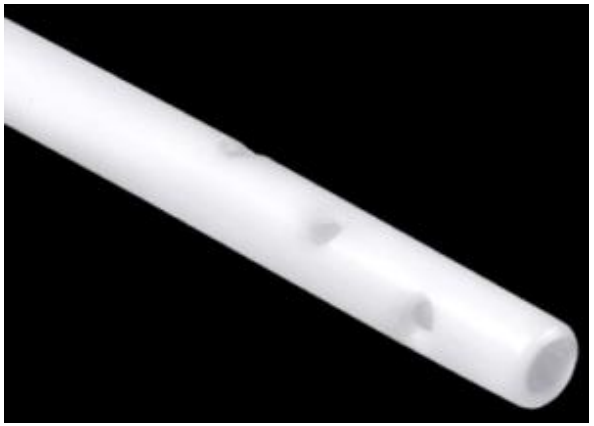
Tunneled catheter design

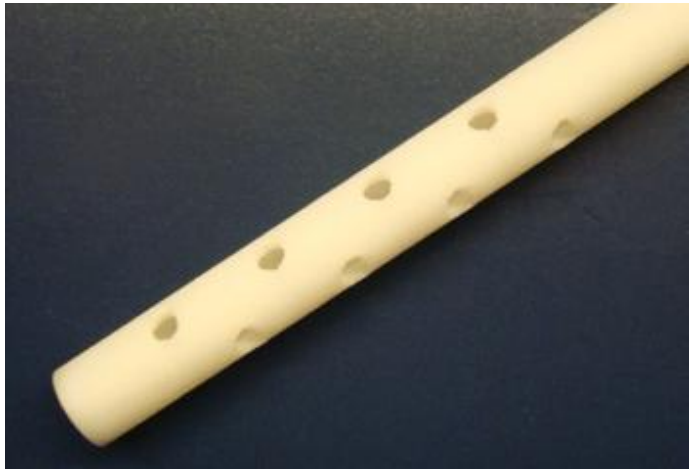
Single lumen vs double lumen CVC



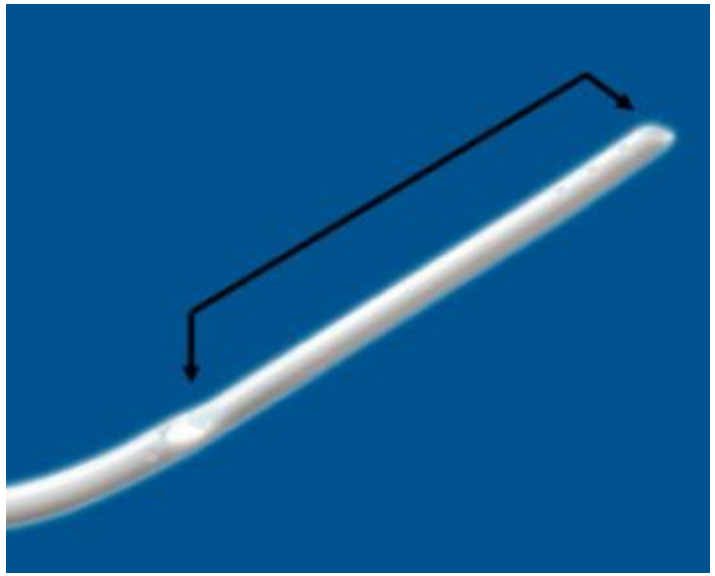
Cuffed, long term tunneled CVC

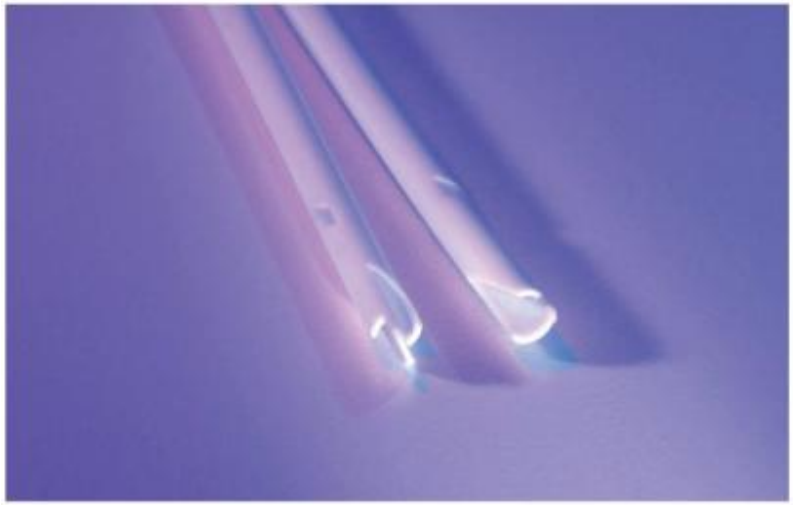
Catheter tip design
Side holes versus no side holes





Catheter tip design
Split tip, step tip, symmetric tip

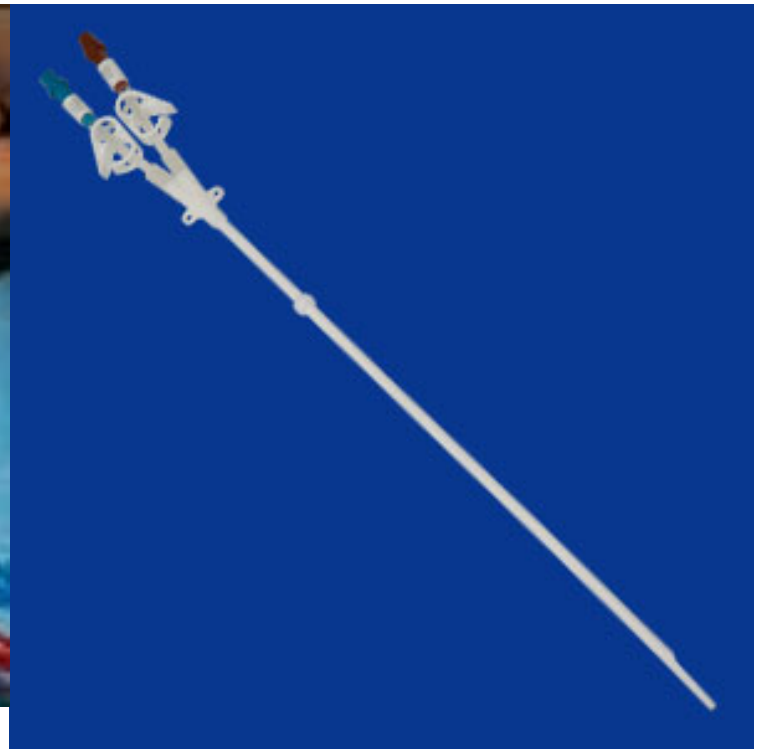




CVC for hemodialysis
State of the art

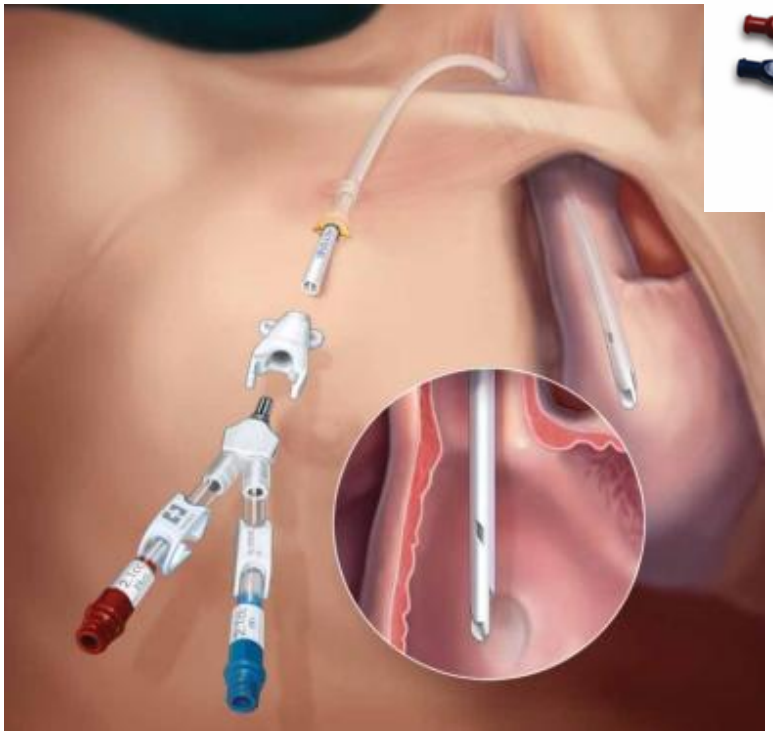
- Catheter design: Temporary vs long term tunneled CVC
- Antegrade versus retrograde tunneling
- Tip design and tip positioning
- New devices: inside-out access

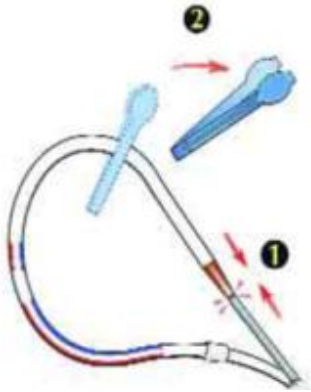
Antegrade versus retrograde tunneling



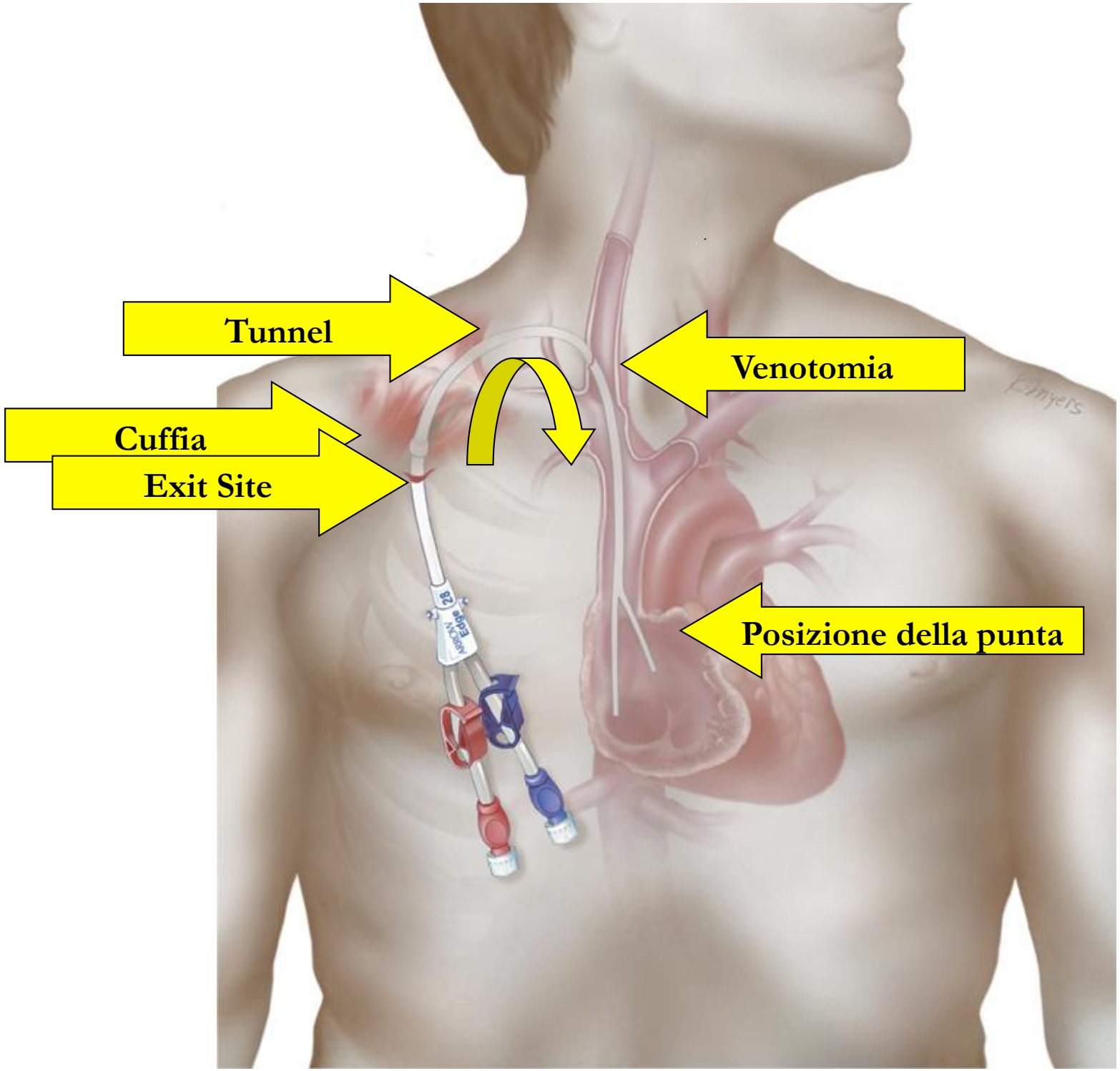
Antegrade

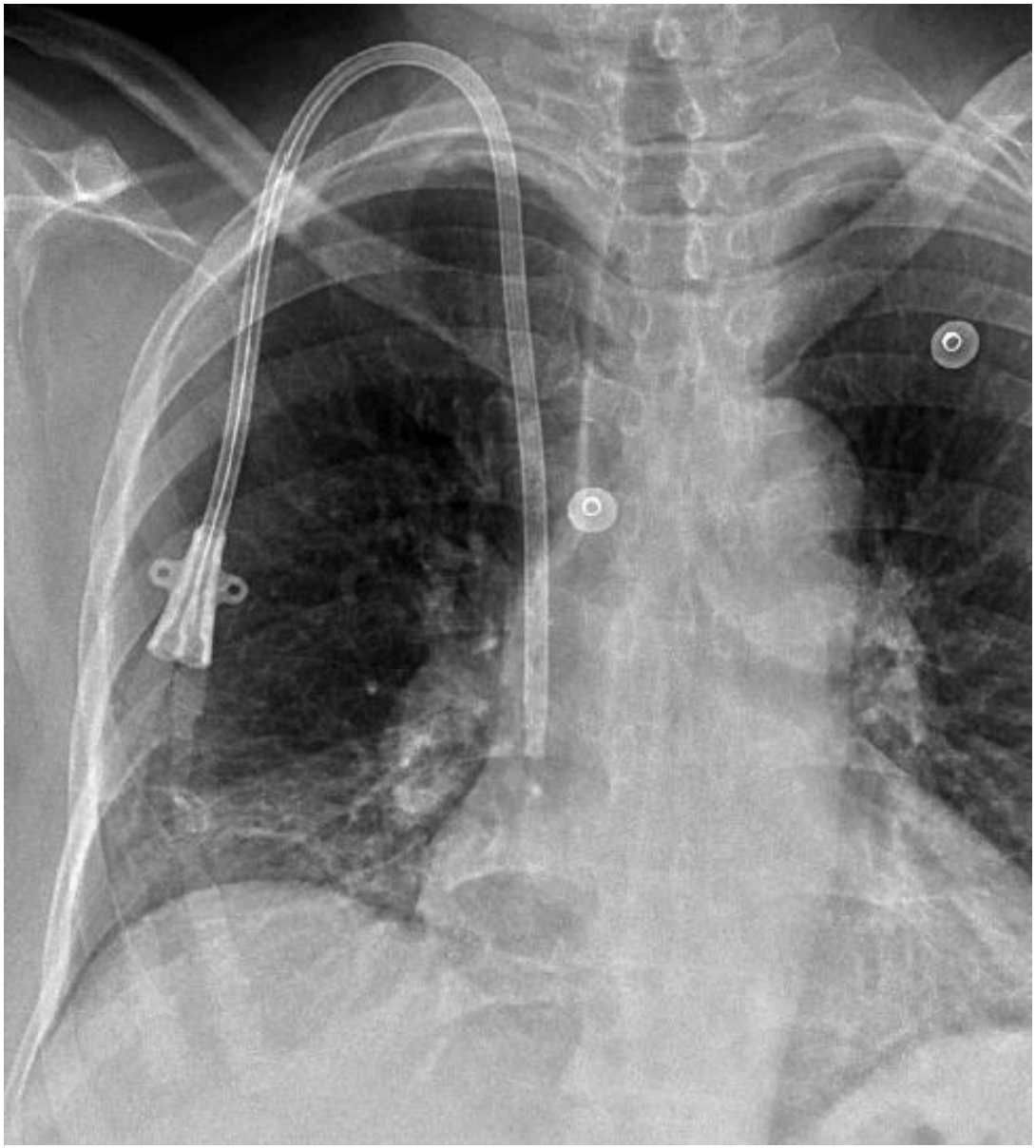
Antegrade versus retrograde tunneling





Retrograde


Tunnel
Venotomia
Cuffia
Exit Site
Posizione della punta



Chest X-Ray showing a correctly positioned CVC

CVC for hemodialysis
State of the art

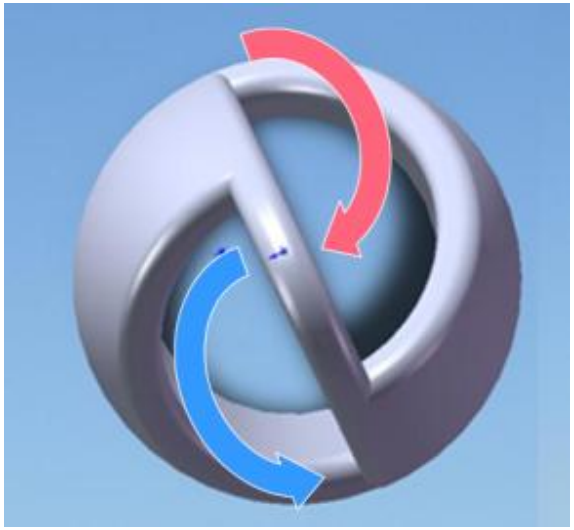
- Catheter design: Temporary vs long term tunneled CVC
- Antegrade versus retrograde tunneling
- Tip design and tip positioning
- New devices: inside-out access

Catheter tip design

- **Catheter tip design has important implications for clinical performance**
- **Symmetrical tip catheters have become alternatives to split tip and step tip catheters owing to low solute recirculation and ease of positioning**
- **Evidence emerging that symmetrical tip catheters may have lower rates of catheter dysfunction**

Hwang HS et al. Comparison of the Palindrome vs. step-tip tunneled hemodialysis catheter: a prospective randomized trial. Sem Dial 2012
Kakkos SK et al. Effectiveness of a new tunneled dialysis catheter in preventing catheter malfunction: a comparative study. JVIR 2008

Symmetrical catheter tip design



LETS TALK ABOUT CATHETER TIP PLACEMENT

A TIP PLACED TOO HIGH MAY LEAD TO AN OCCLUDED SVC

Courtesy of M. Tal

IF THE TIP IS PLACED TOO LOW IT MAY LEAD TO:

Catheter malfunction.

Right atrial thrombus.

Cardiac perforation.

Tricuspid valve damage.

Arrhythmia.

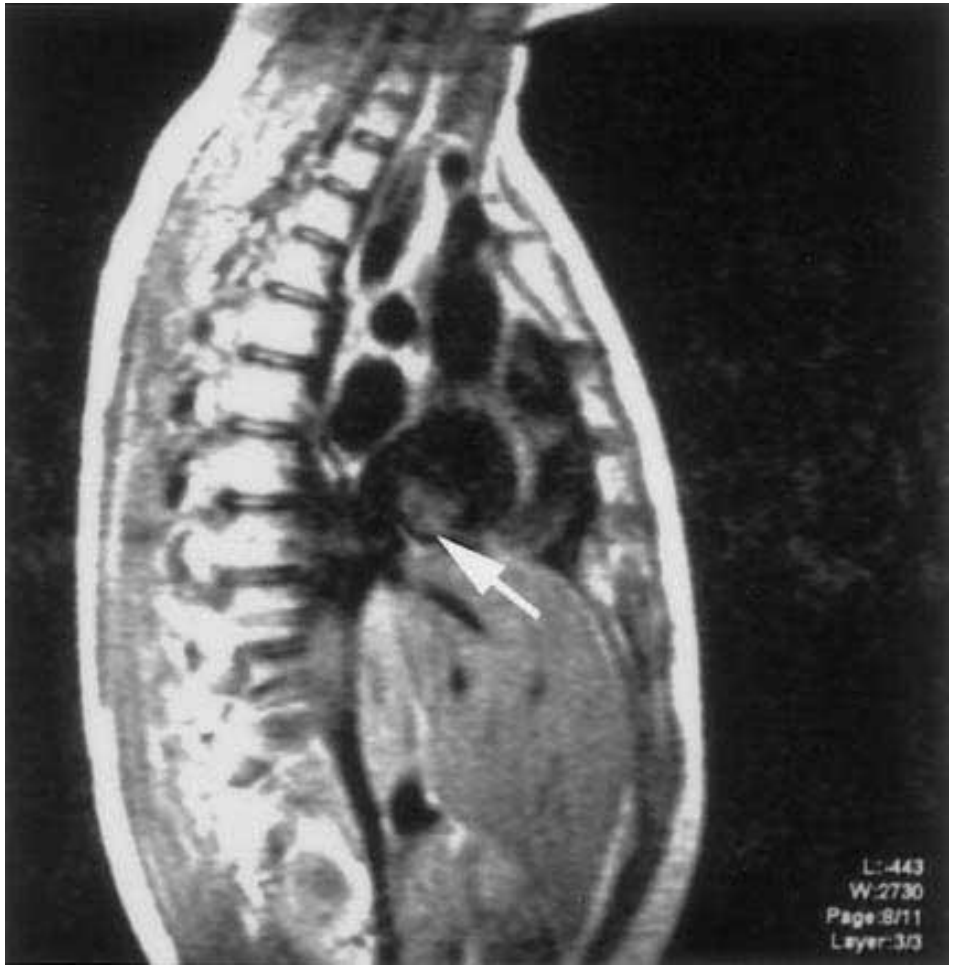
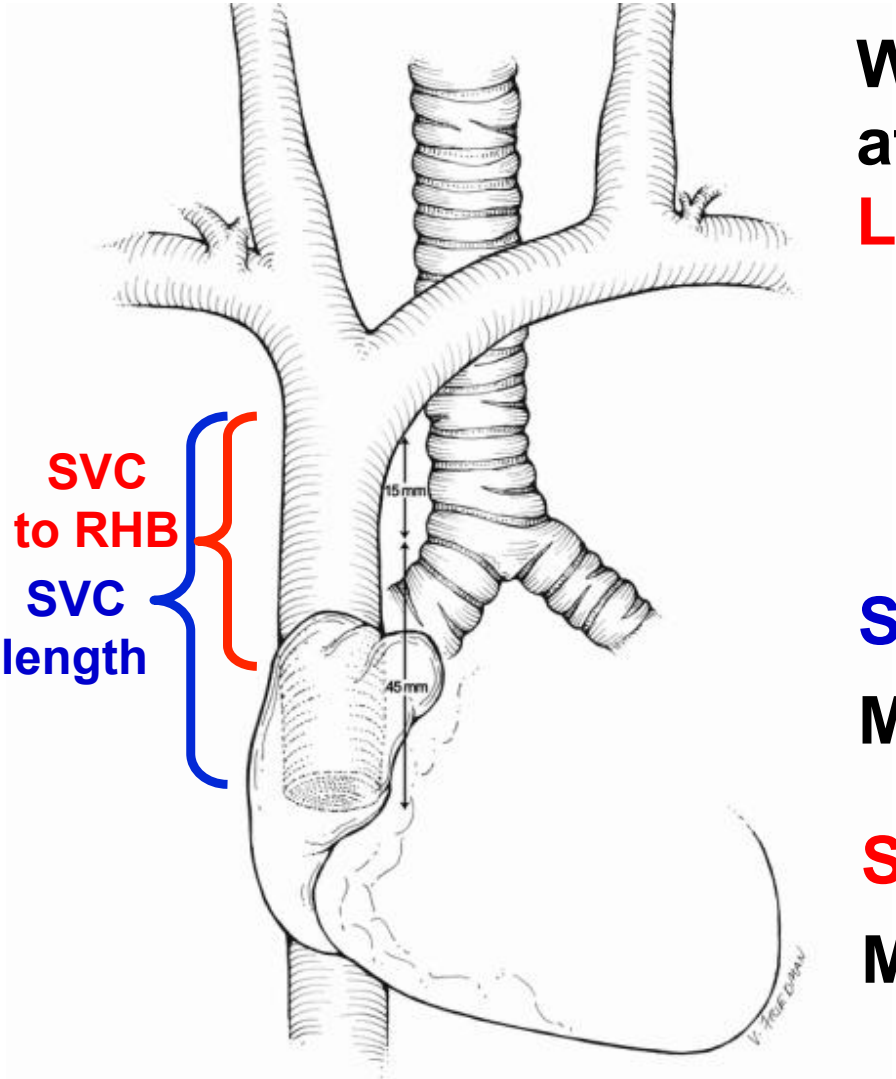


Image from MK Ghani et al. Intensive Care Med (2003) 29:1829–1832

CVC tip position



Where is the upper right atrium?

Lower than it appears

SVC Length

Mean: 6.6 cm (Range 4.4 – 10)

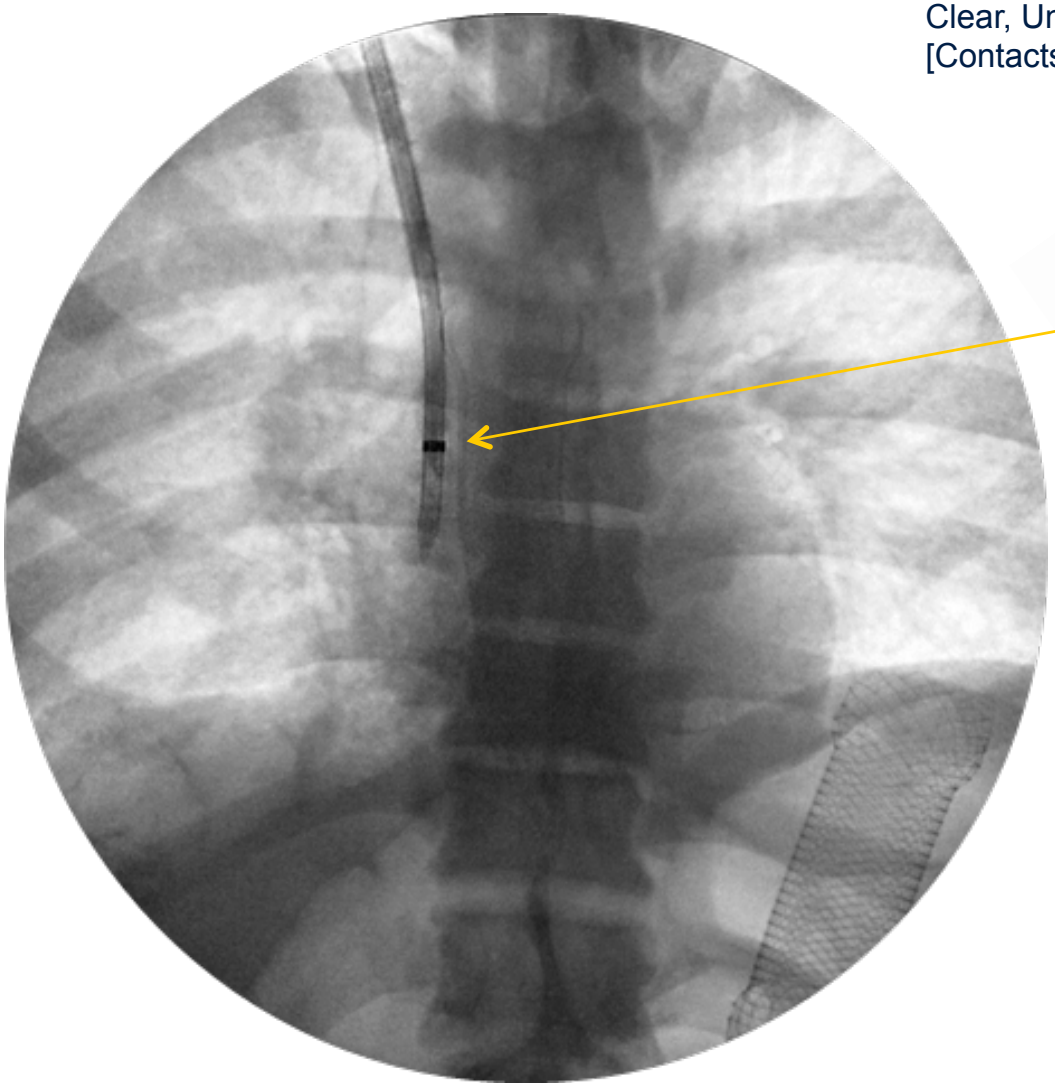
SVC to Right Heart Border

Mean: 5.8 cm (Range 2.5 – 10)

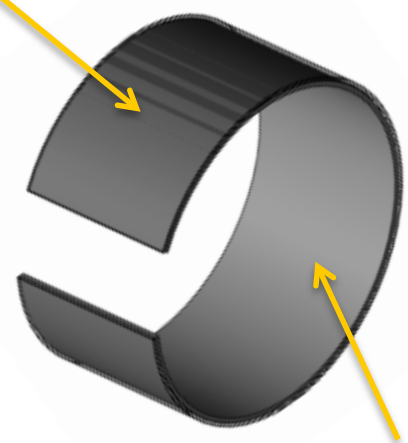
Aslamy Z et al. Chest 1998; 114:820-826

Figure: Tom Vesely

ACCURATE TIP POSITION FACILITATED BY TUNGSTEN MARKER



Outer Layer
Clear, Unfilled TPU
[Contacts bloodstream]

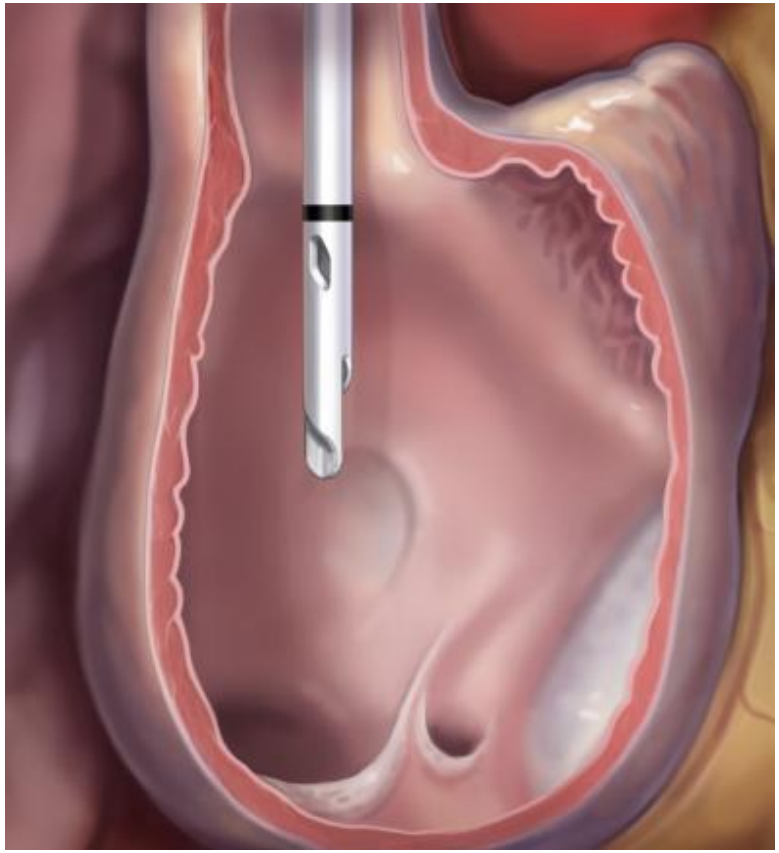


Inner Layer
TPU / Tungsten compound
[Contacts catheter shaft]

CAUSES OF EARLY CATHETER FAILURE

20%

Poor tip position accounts for 20% of early catheter removals

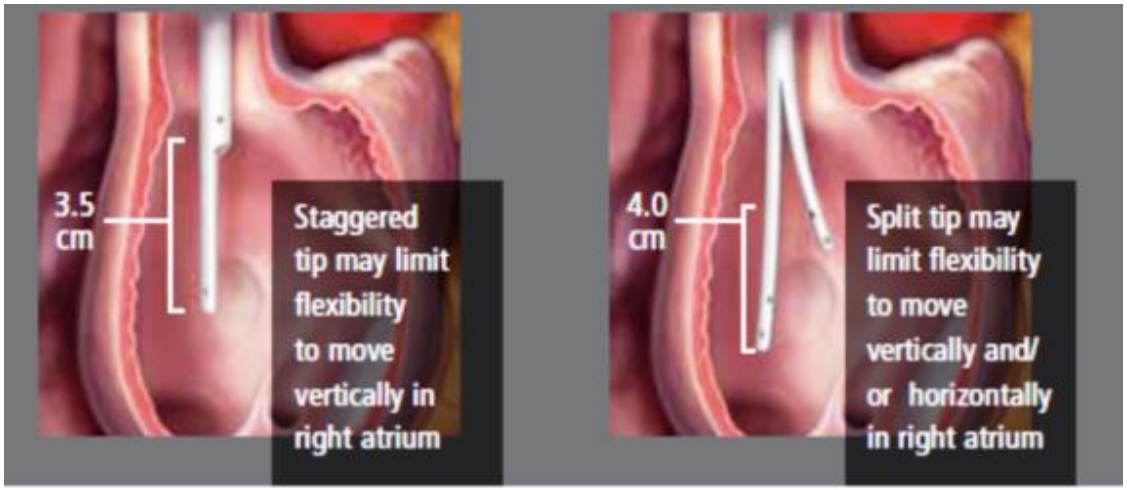


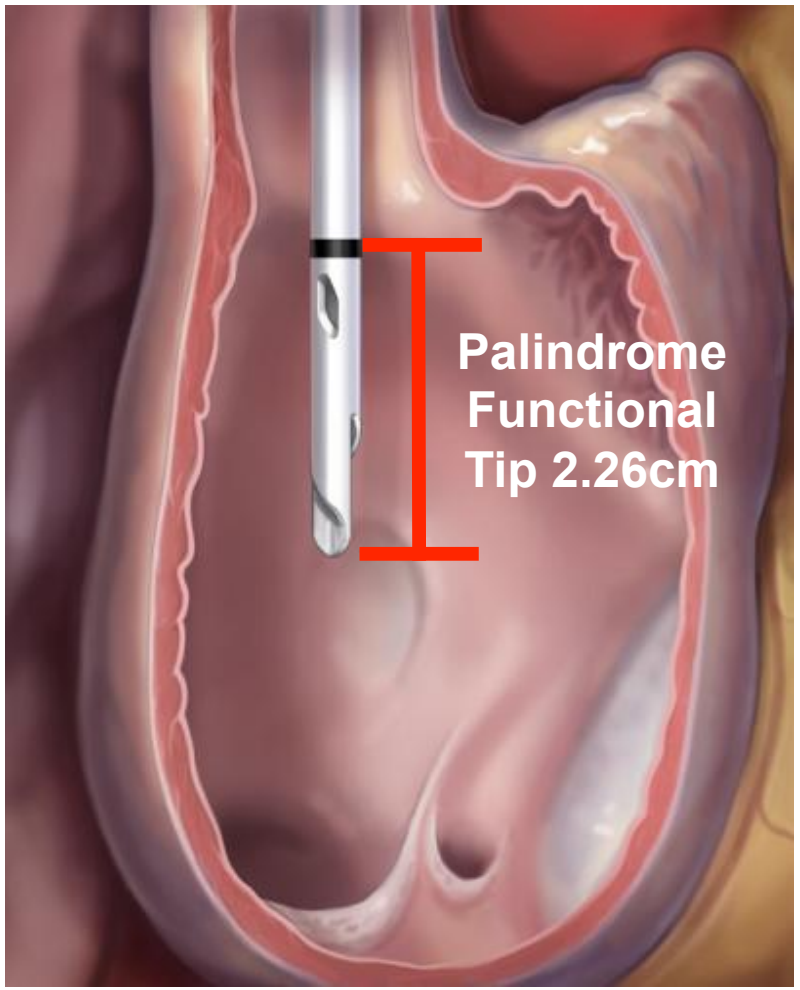
Wong, Jk et al. Analysis of Early Failures of Tunneled Hemodialysis Catheters AJR, 179:357-363,2002

Courtesy of M. Tal

TIP PLACEMENT
ENTIRE FUNCTIONAL TIP WITHIN RIGHT ATRIUM

The average size of the right atrium on the long axis is 4.4 – 4.6 cm. Thus, it is easier to place a symmetric tip CVC, with a shorter functional tip





CVC for hemodialysis
State of the art

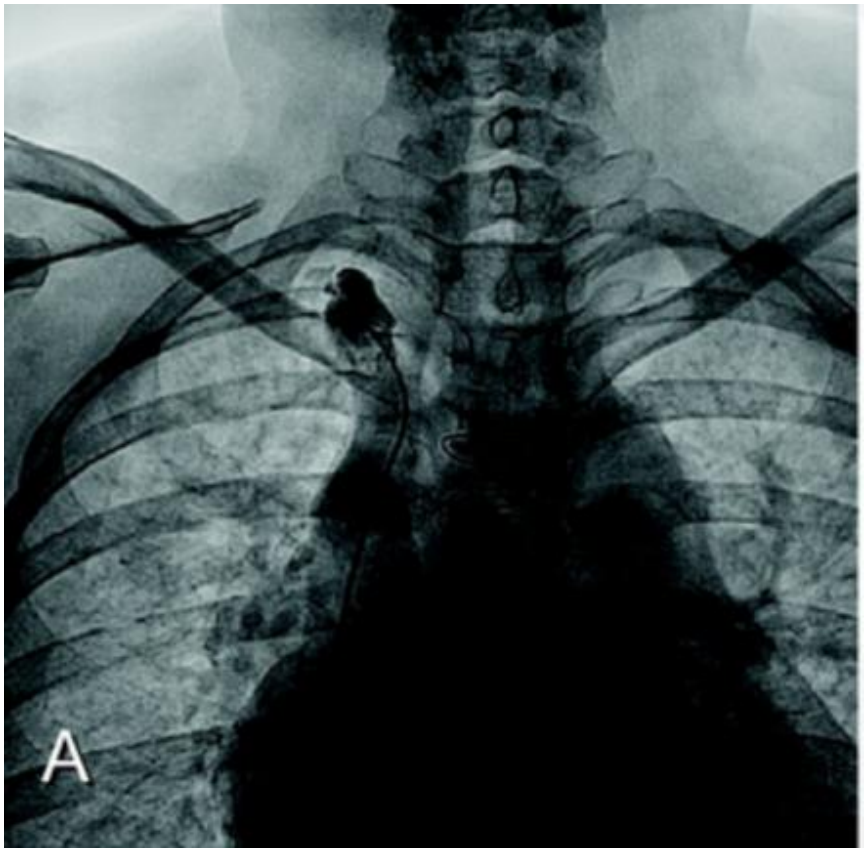
- Catheter design: Temporary vs long term tunneled CVC
- Antegrade versus retrograde tunneling
- Tip design and tip positioning
- New devices: inside-out access

Superior Vena Cava Syndrome

Kumar B - NEJM 2014; 371: 1142

New devices

- The number of patients who require a permanent dialysis catheter, pacemaker and defibrillator is growing at a time when the prevalence of complex central venous obstruction is also increasing.
- Venus obstructions prevents conventional access

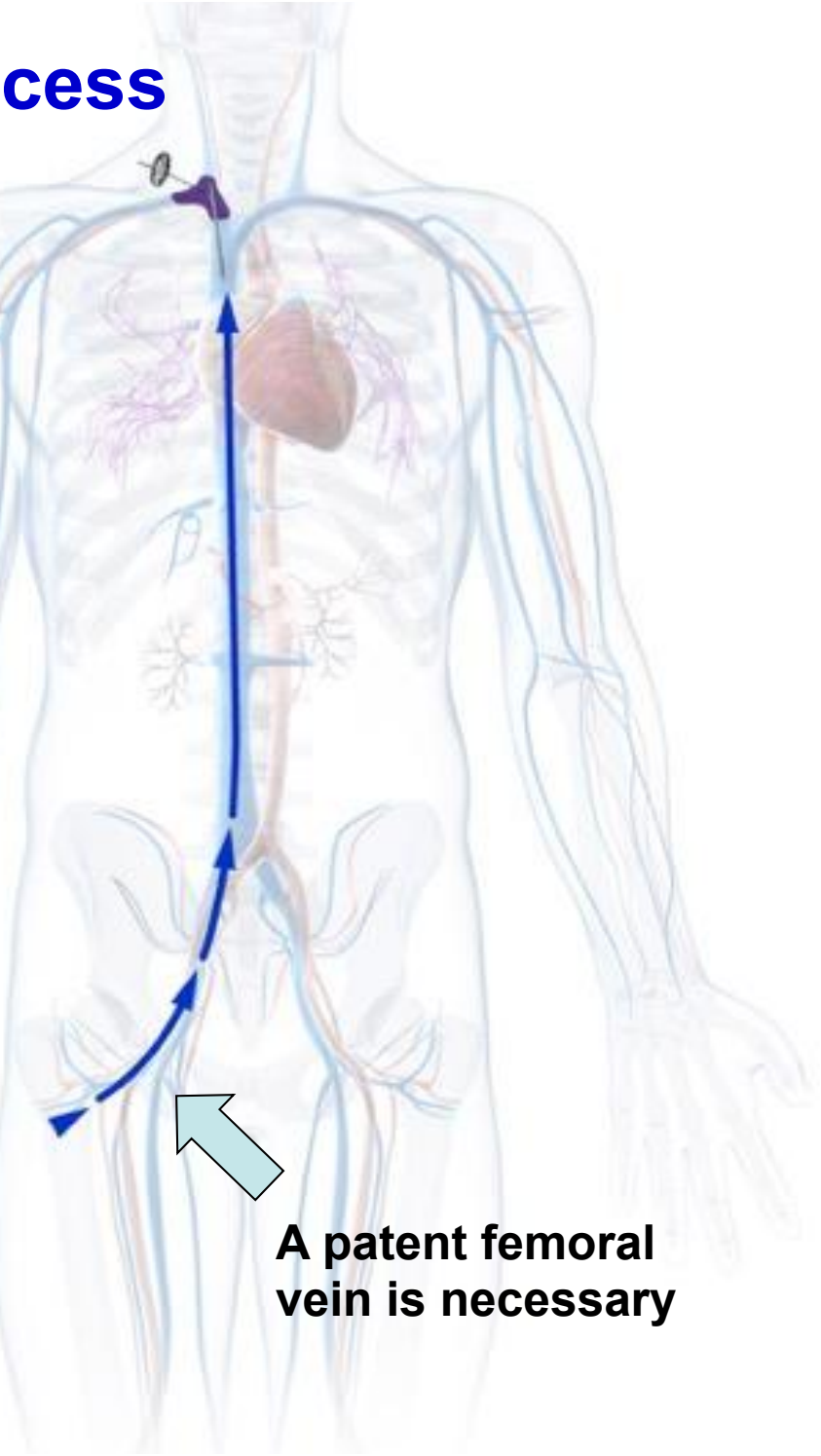


Contrast venography showing total occlusion of the right subclavian and internal jugular veins.

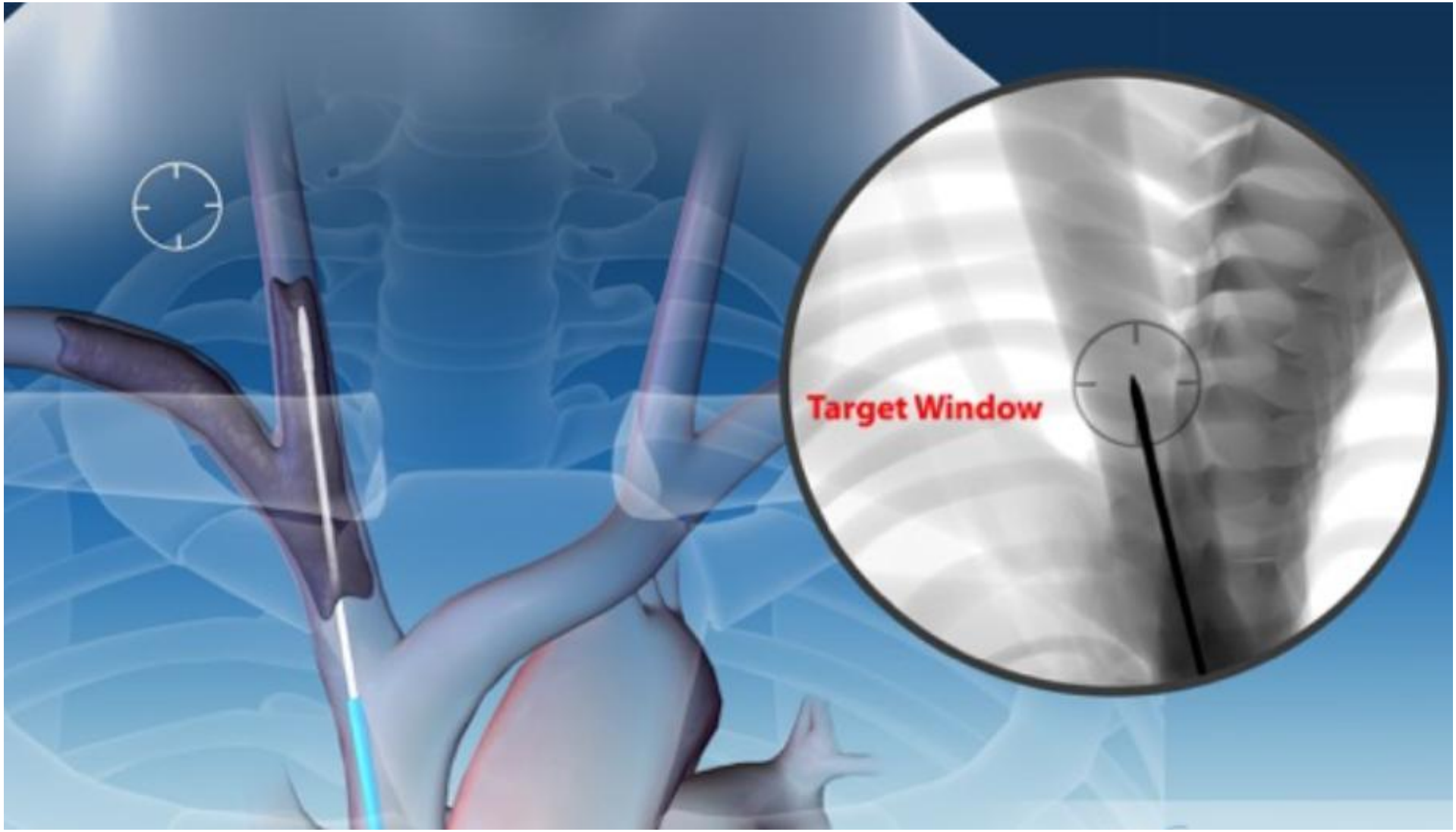
Elayi CS, et al. Heart Rhythm. 2011;8:851-7

Inside-out central venous access

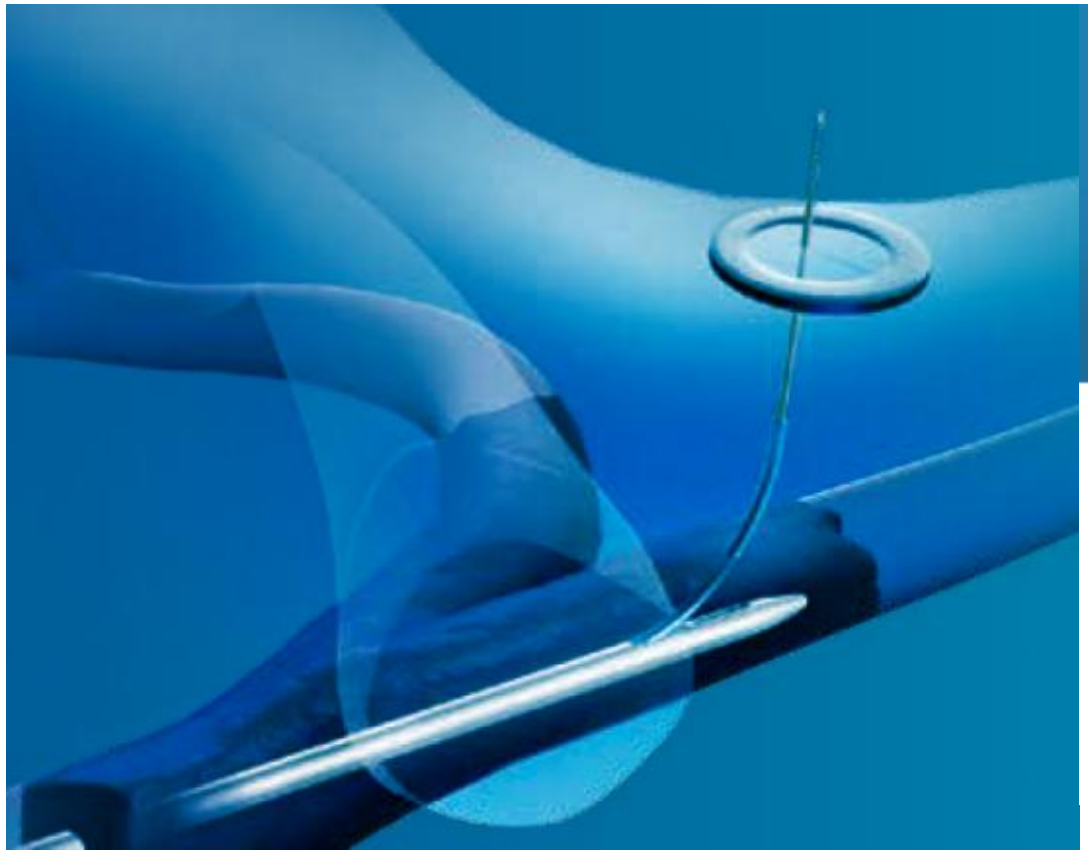
1. Percutaneous femoral approach.
2. A catheter-dilator system is advanced via the right atrium to the most central point of venous occlusion.
3. The occluded vein segment is punctured with a directionally guided needle, which is advanced along intravascular or extravascular tissue planes close to the desired exit site.
4. A solid wire needle is oriented toward the skin surface and advanced through the soft tissues until it exists from the body through an external target area.
5. The wire is then used to pull rigid dilators through the occluded segment.
6. Standard catheters or transvenous leads were can be implanted though the newly created channel.

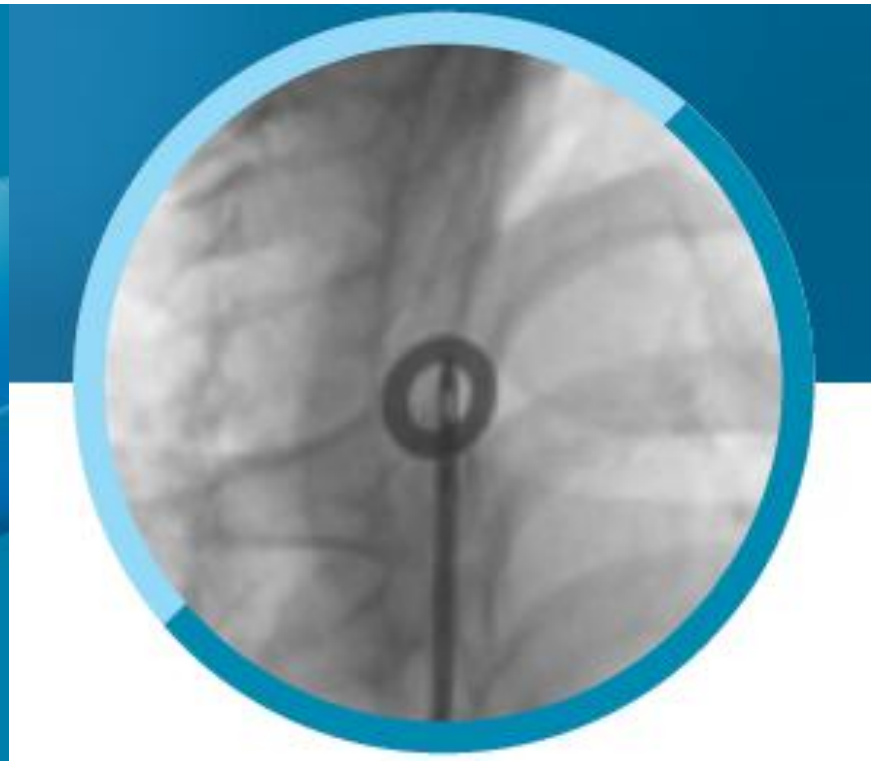


Elayi CS, et al. Heart Rhythm. 2011;8:851-7.



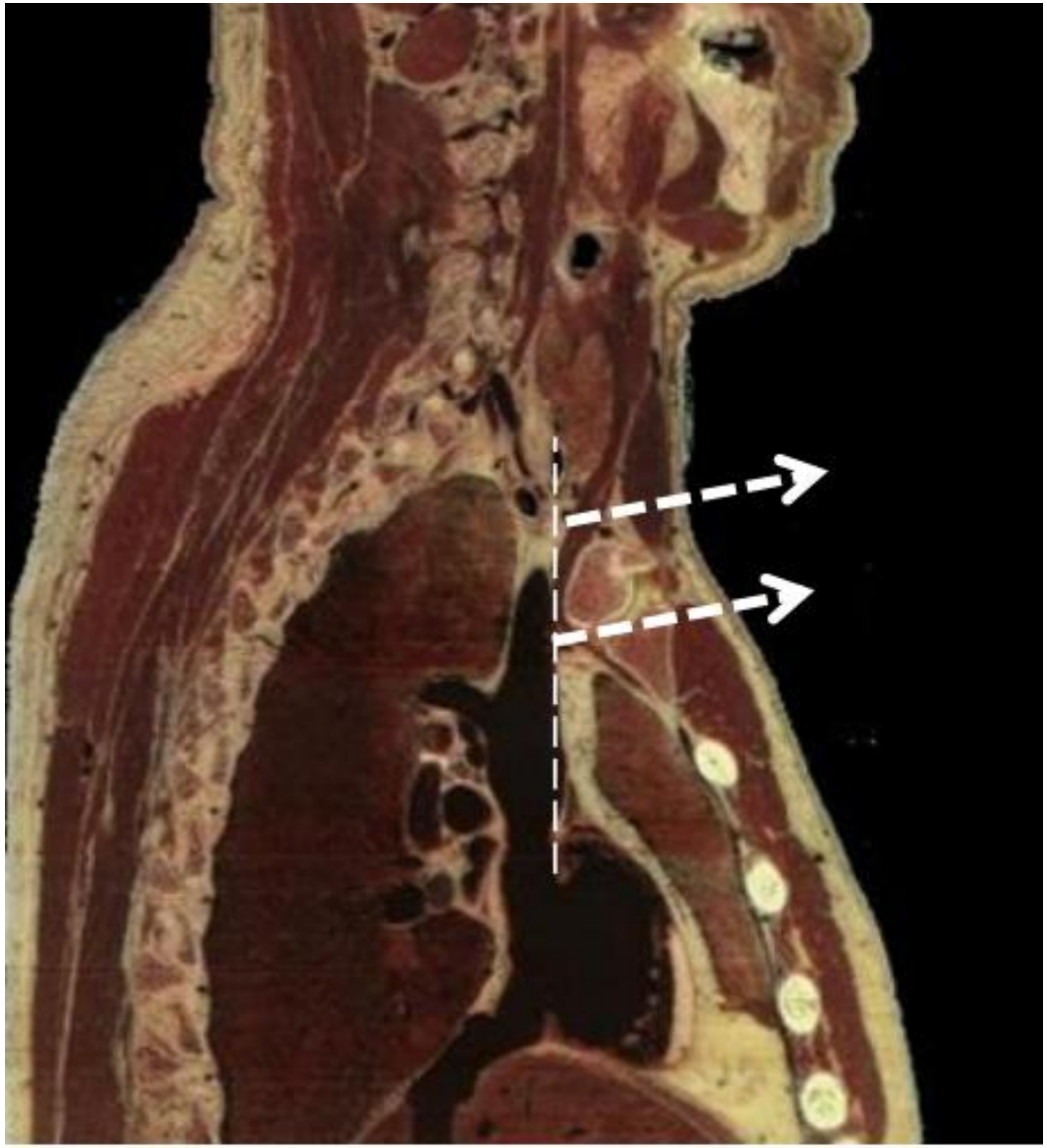
The occluded vein segment is punctured with a directionally guided needle, which is advanced along intravascular or extravascular tissue planes close to the desired exit site





A solid wire needle is oriented toward the skin surface and advanced through the soft tissues until it exists from the body through an external target area.

Gross anatomy of the human thorax in the sagittal plane.

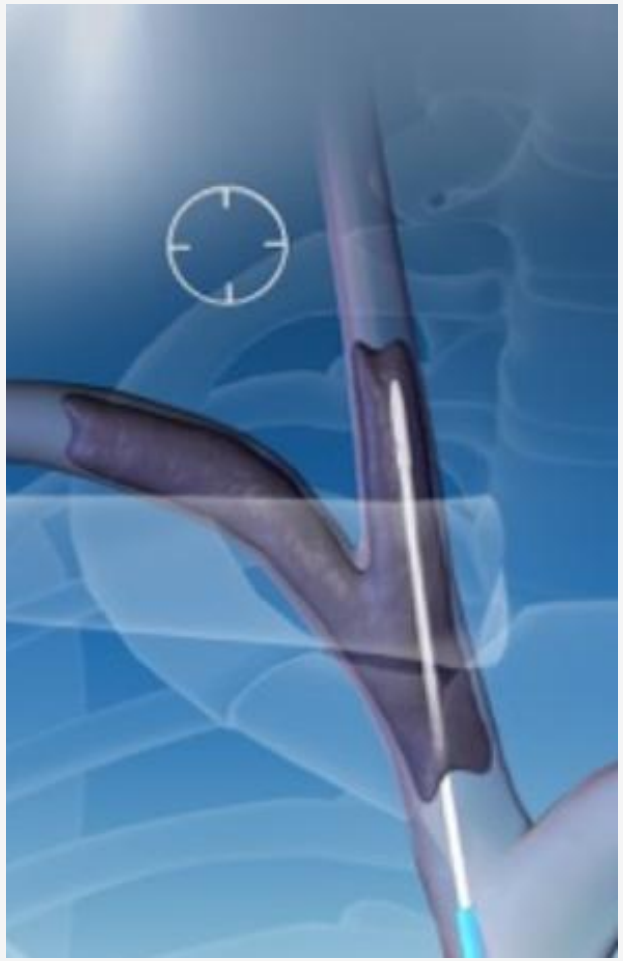


- The vertical line marks the posterior aspect of the head of the clavicle.
- A needle directed anteriorly from this point encounters fat, muscle, and skin.
- Critical structures, including lung, hilar vessels, and arteries, remain posterior to this line.

Elayi CS, et al. Heart Rhythm. 2011;8:851-7.

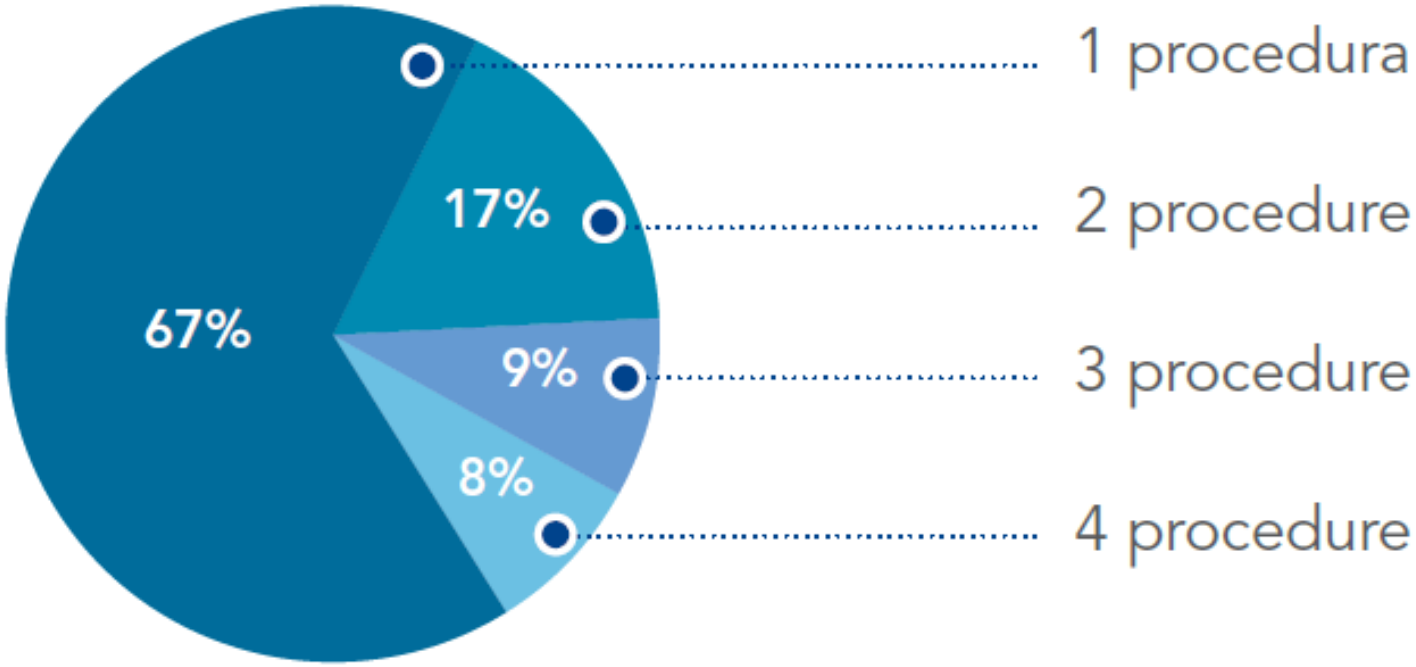
Vantaggi: Ripristino dell'accesso venoso

- **Permette un accesso venoso centrale ripetibile e affidabile alla vena giugulare interna destra**
- **Mantiene accessibili le altre vene centrali**
- **Ottimizza il posizionamento e la maturazione degli accessi arterovenosi permanenti per dialisi**



Procedure ripetute

Numero di procedure ripetute sullo stesso paziente in percentuale
Esperienza clinica con la procedura Inside-Out®.[4]

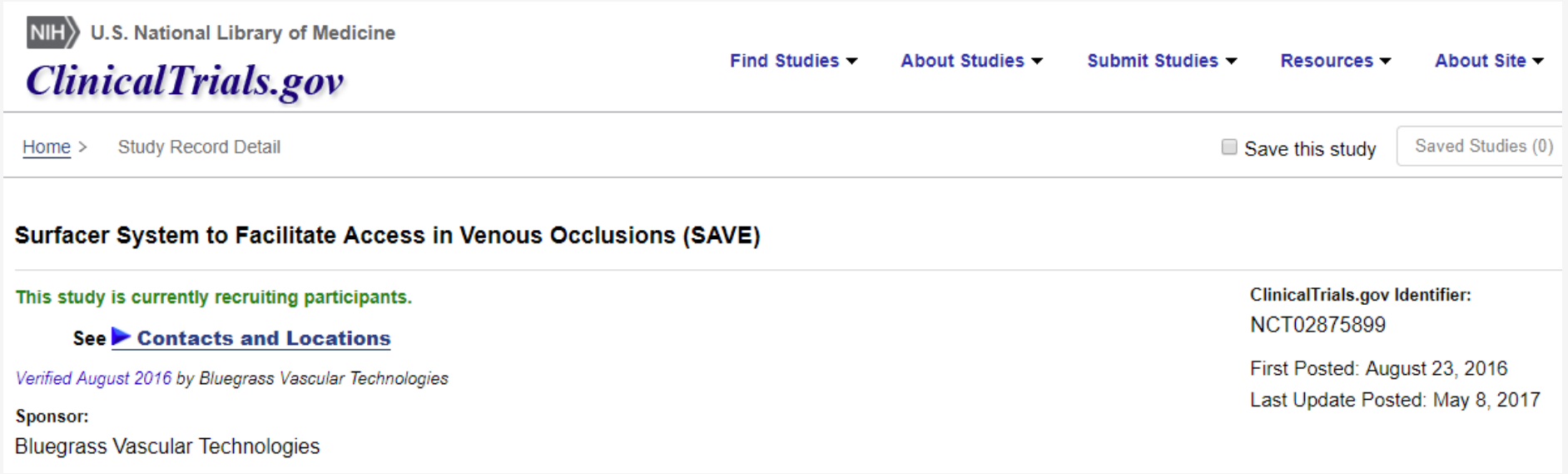


Vantaggi: Riduzione dei costi di cura

L' accesso arterio-venoso permanente ottenuto con il sistema Surfacer*

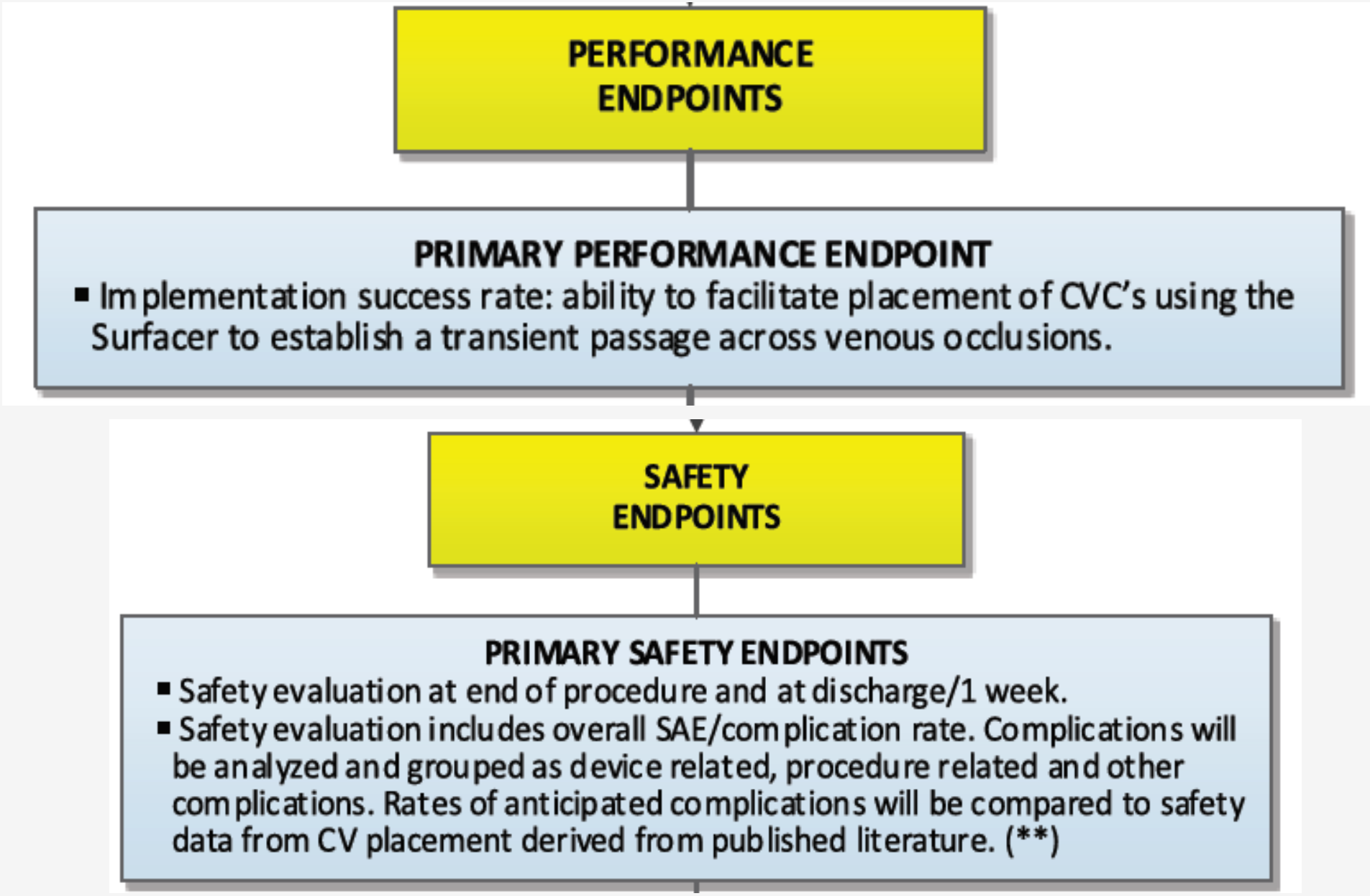
- Arresta la distruzione delle vene
- Migliora la qualità della vita

Post-Market SAVE Study



SAVE (Surfacer® System to Facilitate Access in VEnous Occlusions) Clinical Study:
an international, prospective, multicenter clinical follow-up study designed to confirm clinical performance and safety of the Surfacer® Inside-Out® Access Catheter System, a novel device indicated for obtaining central venous access in patients with chronically occluded veins

Bluegrass Vascular Post-Market SAVE Study



Conclusions

- Catheters increase the risk of death and they should be avoided but they may also be lifesaving
- Tunneled dialysis CVC tips should be positioned in the right atrium for proper functioning
- Symmetrical designs have a shorter functional tip
- New catheter design and features are available, and more are needed for prevention of thrombosis and infection
- New techniques for catheter placement (inside-out approach), allowing better preservation of veins, are very promising

VAS Course - 15-17 November 2018
Torino, Italy

Vascular Access Society

sin reni
Società Italiana Nefrologia